THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION
100 CAMBRIDGE STREET, BOSTON MA 02114

D R A F T

Policy for Developing Water Needs Forecasts for Public Water Suppliers and Methodology for Implementation

Effective Date: February 8, 2001
DRAFT DATE: April 25, 2007

I. POLICY STATEMENT

It is the policy of the Commonwealth of Massachusetts that the Water Resources Commission (WRC) shall review and approve water needs forecasts for water suppliers and communities seeking additional water withdrawals under the Water Management Act (WMA) and for other planning or regulatory purposes as deemed appropriate by the Commission. As a result of the development of the water needs forecast, the WRC may make recommendations to the communities or public water suppliers regarding water use, system efficiency or other issues. Where such water needs forecasts may be pursued for actual withdrawal use by a community, at a minimum, permitting by the Massachusetts Department of Environmental Protection (MassDEP) is required.

II. BACKGROUND AND REQUIREMENTS FOR DEVELOPING A WATER NEEDS FORECAST FOR PUBLIC WATER SUPPLY SYSTEMS

A. Introduction and History

The Water Management Act (MGL Ch. 21G) requires that the Massachusetts Water Resources Commission adopt principles, policies and guidelines necessary for the effective planning and management of water use and water conservation in the Commonwealth. Recent policies adopted by the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) or the WRC include the Massachusetts Water Policy (EOEA 2004), Water Conservation Standards (EOEA and WRC 2006), Water Supply Policy Statement (WRC 1996), and this Policy for Developing Water Needs Forecasts for Public Water Suppliers (WRC 2001).

In 1991, the Water Resources Commission approved a methodology to forecast the most likely volume of water needed by the service population of a public water supply system at a specific future date. That methodology was, in turn, a revision of one that was developed in the mid-1980s. Since the methodology was approved in 1991 and the Policy for Developing Water Needs Forecasts was approved in 2001, the Commonwealth has adopted revised Water Conservation Standards (WRC 2006). In addition, there has been a general trend toward increasing system efficiency and improved water system management by public water supply systems. This revision of the Policy and Methodology reflects those more recent changes. This policy and methodology should be

reviewed periodically to assure that they conform to the most recent developments in system efficiency, system management, and new technology for efficient water use.

B. Purpose and Approach

Communities and public water suppliers seeking to increase existing water withdrawal volumes or to obtain approval for new withdrawals under the WMA must institute all practical and feasible measures to maximize water conservation and system efficiency throughout all components of their water supply system. They also are strongly advised to satisfy current and future water needs by investigating all feasible alternative sources of supply as outlined in the Massachusetts Water Policy (EOEA 2004) and the Water Conservation Standards (2006). This document provides guidance on how to obtain an approved water needs forecast and explains the methodology used by WRC staff in developing water needs forecasts. The methodology is based on historic and existing water use patterns, population projections, and water use efficiency and conservation improvements. It does not address water source availability or impacts that additional water withdrawals may have on water resource sustainability, environmental resources, or competing users. A water needs forecast is not intended as a water-use entitlement; it does not comment on which source a community should use in order to satisfy future demand; nor does it comment on how much of a source can be used. In addition, forecasts may be conditioned by DEP based on an analysis of physical and environmental constraints and impacts of specific water supplies.

Step One: Consultation A community or public water supplier that is experiencing an increase in water withdrawals, that is approaching its registered or permitted withdrawal volume, and expects future increases to continue, should consult with WRC staff at the Department of Conservation and Recreation, Office of Water Resources. Staff will work with communities, water suppliers, and their consultants to review existing data and system operations to determine the current status of water use, water-use efficiency and community growth indicators affecting water use. Based on this review, WRC staff may conclude either (a) that the community has demonstrated a need for additional water supply and has adequate data to enable WRC staff to prepare a forecast or (b) that there is inadequate information to determine the need for additional water, in which case, staff may make recommendations either for the collection of additional information or other actions (see section E, below).

Step Two: Developing a Draft Forecast Working with the community and/or water supplier, WRC staff will develop a draft water needs forecast. The draft volume amounts will be presented to the WRC for consideration and approval. Once approved, the community or water supplier may use these volumes in its application to MassDEP for a Water Management Act water withdrawal permit or for other planning purposes.

C. Incorporation of the 2006 Water Conservation Standards

The Water Conservation Standards for the Commonwealth of Massachusetts (EOEA and WRC 2006) were updated in July 2006, and the water needs forecasting methodology assumes that water suppliers will develop plans and programs to comply with the water conservation standards over time.

The standard for unaccounted-for water, Standard 2.3, is to "meet or demonstrate steady progress toward meeting 10% unaccounted-for water as soon as practicable, especially in those communities in a basin with a higher level of stress." The standard for residential water use, Standard 5.2, is to "meet or demonstrate steady progress toward meeting residential water use of 65 gallons per capita per day (gpcd) including both indoor and outdoor use as soon as practicable, especially in those communities in a basin with a higher level of stress."). It is also expected that water suppliers will implement the Water Conservation Standards in other categories of use and will work with industrial, commercial, and institutional sectors to reduce their uses.

As noted in the Conservation Standards, "The Commonwealth recognizes the existence of circumstances that could affect a community's efforts to fully meet these standards. These circumstances could include aging infrastructure and large seasonal population fluctuations. In such cases, the community should document, as part of its regulatory requirements, all efforts that have been undertaken to comply…." (EOEA and WRC 2006). Communities and water suppliers who feel their situation makes it infeasible for them to comply with the assumptions in the forecasting methodology are encouraged to discuss these issues with WRC staff as soon as possible in the process outlined in Section B above.

D. Minimum Requirements for Preparation of a Water Needs Forecast

All communities or public water suppliers seeking new water needs forecasts must meet minimum conditions, described in the four points below, and must be able to provide accurate and sufficient data to WRC staff. It is not possible to reliably develop forecasts using the WRC-approved methodology unless these data are provided. For certain communities with significant seasonal population fluctuations, such as on Cape Cod and the Islands, determining accurate populations served can be very difficult; however, careful estimates based on experience and efficient record keeping should yield reasonably accurate figures for the purposes of forecasting domestic water use. Water suppliers also should recognize that there can be a considerable lead time in obtaining the needed information, and should plan accordingly.

1. The public water supplier must provide the following information from its Annual Statistical Reports to MassDEP or from other sources for at least the last three, or preferably five, years:
   (a) Water-use information based on actual metering;
   (b) A break down of water use into residential, non-residential and unaccounted-for categories;
   (c) Service population, both year-round and seasonal.

2. Based on the information in #1, and additional information that may be available, the following conditions must be demonstrated in order for WRC staff to prepare a forecast:
   (a) Unaccounted-for water cannot exceed an average of 15% of the total system water used during the most recent three-year period. In cases where the three-year average exceeds 15%, communities and/or water suppliers should consult with WRC staff to assess the feasibility of developing a forecast with current data.
   (b) All systems which have unaccounted-for water exceeding 10% must have a program in place to reduce unaccounted-for water to 10% or less as soon as practicable.
   (c) Residential water use must not exceed an average of 80 gallons per capita per day (gpcd) in the most recent three-year period. In cases where the three-year average exceeds 80 gpcd, communities and/or water suppliers should consult with WRC staff to assess the feasibility of developing a forecast with current data.
   (d) All systems which have residential water use exceeding 65 gpcd, must have a program in place to reduce residential water use to 65 gpcd or less as soon as practicable.

3. The water supplier must have completed a Water Conservation Plan questionnaire (WRC 2007) to provide an overview of system operations and water conservation programs.

4. A community or public water supply system with an existing WMA permit must demonstrate that all conditions of the permit have been met. MassDEP will confirm that the conditions have been met or substantially complied with, or an approved plan is in place to meet the conditions in a reasonable and specified time.

E. Interim Allocations of Water

Public water suppliers that cannot provide information required to enable development of a water needs forecast as described above, or cannot meet the conditions noted in section D, should consult with WRC staff. In these cases, MassDEP may issue a permit with an interim allocation of water. This interim allocation volume is based on the most recent three to five years of water use by the public water supplier and is developed by WRC staff in consultation with MassDEP. Factors considered in determining the interim allocation volume include, but are not limited to, number of new users, non-residential development, climatic conditions, changes in system operations, infrastructure condition, and new metering information. This interim allocation is intended to provide a stop-gap volume to communities that can demonstrate a pressing need for water above an existing permitted or registered volume, but cannot meet the conditions described in section D, above. For these communities, the interim allocation, and the Water Management Act permit that may include these volumes, is intended to be temporary, until sufficient and adequate data can be developed to clearly document current use and future needs.

MassDEP requires those permitted with interim allocations to collect and submit the data needed to calculate current water use and future needs within four years of the permit issuance date. It is expected that communities receiving an interim allocation will undertake specific and effective measures to meet or demonstrate steady progress toward meeting the requirements noted in section D, above. MassDEP may also require the water supplier to provide interim reports containing the required information before the five-year permit review under the Water Management Act. Upon submittal of that additional information, WRC staff will determine

whether or not the information collected and provided is sufficient and accurate enough to develop a water needs forecast for the remaining years of the permit period or if other steps are required, including compliance with administrative consent orders or other actions required by MassDEP. If the water needs forecast is approved by the Water Resources Commission, MassDEP may permit withdrawal volumes that are consistent with the forecast. In such a case, all conservation requirements will apply as they would to any other permit.

Should the water needs forecast indicate that future demand will be less than those volumes used in the interim allocation, MassDEP will allocate volumes through a permit modification consistent with those developed in the revised forecast. Should the water needs forecast indicate that future demand will be greater than the volume in the interim allocation, the public water supplier may choose to apply for a permit based on that volume. If the water needs of the public water supplier can be met with the interim allocation volume, the water supplier may, with MassDEP's approval, extend the interim allocation until the next five-year review period of the permit or until the expiration of the permit.

III. GENERAL WATER NEEDS FORECASTING METHODOLOGY FOR PUBLIC WATER SUPPLY SYSTEMS

This methodology uses the most recent three to five years of water use (called Base Demand) for each public water supplier. Water use data are disaggregated into three main categories: residential, non-residential (including commercial, industrial, agricultural, municipal), and unaccounted-for water (UAW).

The main components of this disaggregated approach and the calculations used to arrive at the forecast are detailed below. Forecasts usually are for the 20-year period coinciding with the WMA permit period. A general assumption in the methodology is that water conservation and efficiency will increase for existing and future residents, commercial and industrial enterprises, municipal facilities, and water suppliers. The attached spreadsheet shows the columns referred to in the description of the methodology.

Definitions

Average Day Demand (ADD) is the total water consumption by all users in the service area, averaged over the calendar year and measured in millions of gallons per day (mgd).
Base Demand is the average of the most recent three- to five-years' ADD.
Base Service Population is the number of people using the Base Demand.
Gallons per Capita per Day (gpcd) is the daily average residential water use measured in gallons used per person in the service area.
Seasonal Population is the number of people served by the public water supply system who do not live year-round in the service area but who reside in the service area during certain months of the year..
Unaccounted-for water (UAW) is defined as "the residual resulting from the total amount of water supplied to a distribution system as measured by master meters, minus the sum of all amounts of water measured by consumption meters in the distribution system, and minus confidently estimated and documented amounts used for certain necessary purposes as specified by MassDEP." (EOEA and WRC 2006**).**

Abbreviations

ADD	average day demand
ASR	Annual Statistical Report
EOEEA	Executive Office of Energy and Environmental Affairs
gpcd	gallons per capita per day
MassDEP	Massachusetts Department of Environmental Protection
mgd	million gallons per day
MISER	Massachusetts Institute for Social and Economic Research
PWS	public water supplier
UAW	unaccounted-for water
WMA	Water Management Act (MGL Ch. 21G)
WRC	Water Resources Commission

Column A identifies the community or water supplier for which the projection is being done.

Columns B through F show the current population and base service population. Data are obtained from the water supplier, town planner or clerk, regional planning agency, or other sources.

- Column B shows the most recent year-round population estimate for the entire community.
- Column C shows the percentage of the population served by the water supply system.
- Column D shows the number of out-of-town residents who are served by the water supply system.
- Column E, the annualized additional seasonal population, is calculated by multiplying the additional seasonal population by the percentage of the year that this additional population is present in the service area. For instance, if a community estimates that during the summer months of June, July and August, an extra 1,200 people use public water in the community, 1,200 is multiplied by 25% (i.e., one-fourth of the year) to obtain an annualized seasonal population of 300.
- Column F, the base service population, is calculated by multiplying column B, the current population estimate by column C, the percent of the population served by the water supplier, then adding column D, the out-of-town population, and column E, the annualized seasonal population, to this product.

Columns G through N show the water use for the base period.

- **Column G**, base system average day demand (ADD), shows the average of the average day demand, in million gallons per day, for the most recent three- to five-year period of water use. The water demand information is obtained from the water supplier for each community, based on the ASR submitted to MassDEP.
- **Columns H through J** show the residential portion of the base ADD.
    - Column H (residential ADD) is calculated by multiplying column G (base ADD) by column I (residential percentage of base ADD) or is provided by the water supplier in the ASR submitted to MassDEP.
    - Column I, the percentage of base ADD used by the residential service population, is provided by the water supplier in the ASR submitted to MassDEP.
    - Column J, the residential water use, in gpcd, is calculated by dividing column H, residential ADD, by column F, base service population, and converting from million gallons to gallons by multiplying by one million.

- **Columns K and L** show the non-residential portion of the base ADD.
    - Column K (non-residential ADD) is calculated by multiplying column G (base ADD) by column L (non-residential percentage of base ADD) or is provided by the water supplier in its ASR submitted to MassDEP.
    - Column L, the percentage of base ADD used by the non-residential service population, is provided by the water supplier.

- **Columns M and N** show base unaccounted-for water.
    - Column M, the average daily unaccounted-for water, is calculated by subtracting the residential and non-residential water use from the total water use in G; thus M = G-(H+K).

- Column N, UAW as a percentage of base ADD, is obtained from MassDEP's ASRs.

Columns O through T show how population is projected to change through the water needs forecast's end date. Data for columns O through R are obtained from the regional planning agency, the town, or other sources of demographic data, such as the Massachusetts Institute for Social and Economic Research (MISER).

- Column O shows the population projection for the entire community.
- Column P shows the percentage of the population that will be served by the water supply system in the future. This estimate is obtained through discussions with the water supplier.
- Column Q shows the future out-of-town population served.
- Column R, the future annualized additional seasonal population is the estimated number of seasonal visitors served by a PWS calculated on an annual basis. The method of calculation is the same as that used for column E (annualized additional seasonal population).
- Column S, the future service population, is calculated by multiplying the population projection, column O, by the estimated percentage of the population to be served in the future, column P, and adding the future out-of-town population, column S, and the future seasonal population factor, column R.
- Column T, the change in service population, is calculated by subtracting column F, the base service population, from column S, the estimated future service population.

Columns U through W show how residential water use is projected to change through the end of the forecast period.

- Column U represents the future residential water use in gpcd for the existing population. If the existing residential water use is between 66 and 80 gpcd, it is assumed that the community will undertake all practical efforts to make steady progress toward reducing the existing residential water use. The methodology assumes the system will reach 65 gpcd within five years. As noted in Section C above, communities and water suppliers who feel their situation makes it infeasible for them to comply with the assumptions in the forecasting methodology are encouraged to discuss these issues with WRC staff.
- Column V represents the future residential water use for the new population. The Massachusetts Water Conservation Standards (2006) establish a standard for residential water use of 65 gpcd, and this amount is applied to all new residential users. Those users who already are achieving 65 gpcd or less are assumed to maintain that level in the future.
- Column W represents the future residential average daily demand (in mgd). There are two components to the calculation used to produce column W.
    - First, the demand from the existing residential service population is calculated by multiplying the base service population (column F) by the future residential water use, in gpcd, for the existing population (column U). If existing residential water use is 65 gpcd or below, column J is carried over into column U to obtain one part of the future residential water demand.
    - In the second component, the additional demand from new users is calculated by multiplying column T (population change) by column V (water use in gpcd for the new users). New system users are assumed to use 65 gpcd or less
    - The two components of the calculation are added together and divided by one million to obtain the projected residential ADD in million gallons per day.

Column X, the future non-residential portion of projected demand, is calculated as follows. Non-residential water use, in "gpcd," is first calculated by dividing column K (non-residential ADD) by column F (base service population) and multiplying by one million. Non-residential water use is then converted to million gallons per day and is multiplied by column T, the estimated change in population in the future, to yield the new non-residential water use for the additional (or decreased) population. (In cases where population is projected to decline, this non-residential water use also will decline.) This value is added to Column K (base non-residential ADD). It is expected that a 10-percent overall reduction in non-residential water use can be achieved within a ten-year period. As noted in Section C above, communities and water suppliers who feel their situation makes it infeasible for them to comply with the assumptions in the forecasting methodology are encouraged to discuss these issues with WRC staff.

In calculating **Column Y**, future unaccounted-for water, it is assumed that if existing UAW is 10 percent or lower, the existing percentage will continue in the future. If the UAW is between 11 and 15 percent, it is assumed that the community will undertake all practical efforts to make steady progress toward reducing UAW and achieving 10% or less within 10 years. To obtain this estimate, columns W and X (future residential and non-residential ADD) are added together and then multiplied by a target percentage for future UAW. The target is based on the assumption that current UAW will be at 10% or less within 10 years. As noted in Section C above, communities and water suppliers who feel their situation makes it infeasible for them to comply with the assumptions in the forecasting methodology are encouraged to discuss these issues with WRC staff.

Column Z represents the future increase or decrease in ADD resulting from economic changes, such as a new industry moving to town. These are specific, known projects not captured in column X. Date for column Z are obtained from the water supplier, town planner or regional planning agency.

Column AA, the forecasted ADD, is calculated by adding columns W, X, Y, and Z. Once approved by the WRC, this volume can be used for planning or permitting purposes, including in the Water Management Act permitting process.

References Cited

Executive Office of Environmental Affairs and Water Resources Commission. July 2006. Water Conservation Standards.

Executive Office of Environmental Affairs. November 2004. Massachusetts Water Policy.

Water Resources Commission. April 1996. Massachusetts Water Supply Policy Statement, 1996 Update.

Water Resources Commission. February 2001. Policy for Developing Water Needs Forecasts for Public Water Suppliers.

Water Resources Commission. 2007 (in draft). Water Conservation Questionnaire for Public Water Suppliers.

NOTE: This spreadsheet is part of the April 25, 2007 draft Policy for Developing Water Needs Forecasts for Public Water Suppliers and Methodology for Implementation

BASELINE CONDITIONS, 2005

In this example, "base" for 2005 represents data from 2003 - 2005
Seasonal population of 1,200 is annualized as follows: 1,200 x 25% (3 months) = 300
ADD = Average Day Demand; shown in million gallons per day
GPCD = gallons per capita per day
mgd = million gallons per day

	Current Population				
(A)	(B)	(C)	(D)	(E)	(F)
Community	2005 Town Pop	2005 % Serv Pop	2005 Out-of-Town Pop	2005 Annualized Add'l Seas Pop	2005 Service Pop
OurTown	6000	94%	30	300	5,970

Column F = (B x C)+D+E

Base Population and Water Use							
Residential				Nonresidential		UAW	
(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
Base System ADD (mgd)	Res ADD (mgd)	Res % of Base ADD	Res GPCD	Non-Res ADD (mgd)	Non-Res % of Base ADD	UAW ADD (mgd)	UAW % of Base ADD
0.55	0.44	80%	74	0.04	7%	0.07	13%

Column H = G x I
Column J = H/F x 1,000,000
Column K = G x L
Column M = G- (H + K)

WATER NEEDS FORECASTS

	FORECAST												
	POPULATION						RESIDENTIAL			NON-RES	UAW		
	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)	(Z)	(AA)
Year	Future Population	Future % Service Pop	Future Out-of-Town Pop	Future Annualizd Add'l Seas Pop	Future Service Pop	Pop change, Present - Future	Future Res GPCD Factor for Exist Pop	Future Res GPCD Factor for Proj Pop	Future Res ADD (mgd)	Future Non-Res ADD (mgd)	Future UAW ADD (mgd)	Future Signif. Change ADD (mgd)	**Future Total ADD (mgd)**
2010	6150	98%	40	421	6,488	518	65	65	0.42	0.0411	0.06	0.03	0.55
2015	6300	98%	40	421	6,635	147	65	65	0.43	0.0396	0.05	0.02	0.54
2020	6458	98%	40	421	6,790	155	65	65	0.44	0.0405	0.05	0.01	0.55
2025	6615	98%	40	421	6,944	154	65	65	0.45	0.0414	0.05	0.00	0.55

Column S = (O x P) + Q + R
Column T = S – F
Column W = (F x U + T x V)/1,000,000
Column X = ((7/100000) x T) + K-0.0024
Column Y = (W+X) x 0.115/0.885
Column AA = W + X + Y + Z